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# THE SCHOOL REVIEW

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## TECHNOLOGICAL SCHOOLS—THEIR PURPOSE AND ITS ACCOMPLISHMENT.\*

The purpose of any institution of learning, whether of high or of low degree, is, if I understand it aright, to contribute a defined amount to the education of the boy or girl, man or woman, who may enter its doors. It should have a prescribed plane and area of work ; it should have a settled method ; it should be expected to apply this method, within its own field, to the presentation, by the best of known processes, of the most important facts and principles of those branches of learning which constitute its special province.

The education of the boy or the girl, of the man or the woman, may be said to consist of so much of knowledge of the sciences, the literatures, and the arts as the individual finds it practicable to obtain, by the application of time and thought and study, in hours set apart from those of toil and compulsory occupation. Its purpose is two-fold :—so to exercise the mental faculties and powers as to confer upon the mind capacity for easy and extensive gain of both culture and knowledge ; and to endow it with learning and wisdom—for these are not the same. Culture and wisdom are the highest fruits of education, grafted upon natural talent and power, and, well developed, constituting such character as has been respected and admired in every age of the world. Knowledge is needful and learning is admirable and desirable, to make life successful and to yield substance for enjoyment ; but, apart from culture and wisdom, they fail of their purpose and life falls short of its aim.

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\* Opening the discussion on Technical Education, Chicago, July 26.

From university to primary school and kindergarten, throughout the whole range of human knowledge and of systematically given instruction, every element of the educational structure has its own special place and purpose, contributing to the final and complete result ; but the plan and the scope of these elements may differ widely. The university, if it be a real university, must present to its students the opportunity to become acquainted with the elements, at least, of all the sciences, all the literatures, and all the arts which contemporary life and modern civilization rest upon or imply familiarity with. The primary school usually only makes a beginning, as do all the elementary schools, in teaching the child how to begin to learn by study, and furnishes the first necessary tools for that trade. The kindergarten teaches the child how to learn by observation and direct experiment ; it is the child's laboratory of applied science. But every school and every college and all universities should combine the methods of the conventional primary school with those of the kindergarten. Study, observation, experimental processes and methods, must all unite to produce the most perfect work, in primary school, secondary school, college and university alike, and whether giving the elements and tools of education, the manual exercise required for higher work, or the facts and data and principles of the sciences be the purpose of the school.

But the man must be educated for his coming life, and the lives of men differ. Education, therefore, while having the same general object with all, the cultivation of the powers of the individual and the communication of knowledge and culture, must be given somewhat different directions, and must cover somewhat different fields, for different men, if it is to do its most perfect work on every individual. The man who is independent of compulsory labor, and who may, with reasonable confidence, look forward to a life of his own choice and making, will desire culture, learning, and accomplishments. The youth growing up in the home of the working man, without fortune or reasonable expectation of ever securing even a competence, compelled to look forward to a life of constant and perhaps arduous labor, subject to a competition from neighbors or, often, from working men thousands of miles away, needs, first of all, that knowledge and training which will enable him to hold his own and make sure of subsistence and freedom from privation for his family and himself.

The average citizen, with such capital as a generation or two of industry and skill may have laid aside for him, free to give time and money for such education as can be given him before the approach of manhood brings with it the cares and responsibilities of his later working life, seeks, if he be wise, first the insurance against failure in his vocation, next such culture and such knowledge as he may gain therewith, as a part of or in connection with his preparation for his life work. Finally, the well-to-do citizen possessing competence, but not wealth, seeks for his son or his daughter a scientific training for a profession, and a culture befitting his station in life,—the first the essential, the last the most desired. Every citizen asks the privilege and claims the right to secure as much of necessary preparation for the future of his life and as much of that culture which *is* life as time, means, and natural capacity may permit him fairly to demand.

It was long ago recognized by statesmen and men of mind that one of the first duties of the state is to make sure a fitting education of the people of the state by providing elementary schools for all who choose to avail themselves of them. It was also early admitted that a system of useful elementary education presupposes higher institutions of learning in which the teachers of those schools may be prepared for their work, and in which all the learning of the time may be preserved and given fullest opportunity for extension and expansion. It is now well understood by all intelligent men that the state must, to insure the highest prosperity and enlightenment of its people, directly or indirectly, by legislation or through the stimulated or spontaneous liberality of its wealthy men, superpose secondary schools upon primary, colleges upon the schools, and must place universities at the apex of the structure. The great States of the West have their State universities; the old States of the East have their Harvard and their Yale and Brown and Amherst and Williams, at once monuments to great and statesmanlike citizens among the wealthy classes, and capsheaves of their educational systems. No State so poor and sparsely populated, no statesman so weak and narrow, as to refuse to build to the very peak of the pyramid. In fact, it is often asserted that the true statesman, like Washington and Jefferson, Madison and the Adamses, makes the university the foundation, the secondary schools the body, and the primary schools the supported apex of the system; the whole resting

safely and firmly, if properly constructed, upon a solid and broad foundation of deepest wisdom and greatest learning.

The state must build foundation as well as superstructure and every part of each, if completeness and solidity and permanence are to be made sure. Only the state, as it seems to me, can maintain permanently, certainly, and in efficient, continuous, and steady operation, any single element of this organization ; and only the state can construct and maintain it in symmetry and completeness and build solidly and durably the whole great structure. Private contributions to this purpose and object are too uncertain, irregular in amount, and sporadic in time and distribution, to give that regularity of income or that certainty of any income at all which is an essential element of steady and productive work. Regularity and sufficiency of income, assured by a fixed taxation, as illustrated in our western States, in many instances, is probably the best insurance of life, of continuous growth, and of uninterrupted usefulness of the educational system.

The following facts give some idea of the magnitude of the task to be assumed, and of the impracticability of securing permanence of an educational system by private effort, even were it possible that private liberality and private activity could give the system form and coherent and symmetrical growth.

The United States constitute a nation of about 65,000,000 of people. Of these, three-fifths, about 40,000,000, are minors, and a large fraction of them demand and need instruction in schools of higher and lower degree. In their education, 300,000 teachers are engaged in 200,000 schools, and about \$100,000,000 per annum are paid for the work. The States usually expend about \$25 per capita, and some of the cities about \$35, for elementary instruction alone. The federal government has given over 150,000,000 acres of public lands to this object, and the States have often assigned the first and largest apportionments of their own public lands to their departments of education. In some cases, single institutions have greatly profited by this policy ; but as a rule, education is conducted, in the higher departments, with a most frugal hand.

Culture and scientific training for the practical man are the two purposes of all schemes of education of the individual citizen.

But their order and extent, and their relative importance and magnitude, must depend upon the position in life of the individual, rather than upon his choice or their natural and logical sequence. The proper and logical order would be, first culture, then professional training, first the awakening and strengthening of the mind, then its application to the purposes of culture, then its practical employment in acquiring and practising the chosen vocation, whether that of the engineer who builds, the artist who adorns, the man of letters who entertains and enlightens, the jurist who interprets the law, or the physician or the clergyman who ministers to bodies or to minds diseased, or even that of the man of leisure whose profession is that of the accomplished man of a society of culture. Every intelligent citizen desires for his children so much of culture as his time and means permit him to give them ; his means determine to what extent he must abridge the culture studies, and compulsorily antedate the best time for entrance upon the studies having practical application in the life of the bread-winner. For people of wealth, twenty years of culture and five of professional study may be none too extensive a course ; but the citizen of moderate means must at least terminate his son's studies at twenty-one, and, if he is to have a professional training, it must commence at sixteen or seventeen ; while the so-called " industrial classes " must send their offspring out into the world to earn their own living while still children. It thus happens that the education of the people must, in the main, be such as will give them technological training, with, incidentally, so much of culture as can be offered without detriment to their preparation for the work that must probably be theirs for life. We have here the reason at once for a complete and perfect system of education by the state, and for the organization of special manual training, trade, and professional schools.

Our school and college curricula have hitherto been—and are still in fact—vastly too exclusively literary to meet the needs of the people and of the country. We have made hardly a beginning in the building of that great system of industrial training, supplementing education, which must, if we are to survive in the industrial rivalry of the nations, soon be made to constitute an important and extensive division of the State and of the national educational structure.\*

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\* Technical Education,—by the writer. Trans. A. S. M. E., 1893.

It is this aspect of the case which makes the introduction and perfection of technical education in our own country, and its development as a part of a State and national system, matters of supreme importance to the people and to the nation. Unless our people are at once more intelligent and better trained in their productive vocations than those of other nations, they must be content to settle to a lower level and there remain.

Technical education and technological schools thus constitute for us the most important of all current topics and subjects, in connection with educational work and development in this country. The foundation of technical schools of all grades, from the kindergarten and the purely manual training schools, to the special trade schools and the higher schools of engineering, agriculture, architecture, and art, is the essential and pressing duty of the hour. Their organization and their incorporation into the great educational system of State and nation constitutes the grandest problem of the time, for educator, patriotic citizen, and statesman alike, and the questions: To what extent and in what form should our educational system include technical schools? How shall their distribution among the various vocations and professions be symmetrically effected? To what extent and in what manner should the state sustain them? and What are the deficiencies in number, curriculum, and method, of the schools already established? are those of the hour. These constitute the great problems of the citizen, the educator, the legislator, and the statesman of our time. Such questions as these demand discussion and action, imperatively and continuously. They are more pressing and vital than those of tariff or currency, annexation of adjacent provinces or choice of gold or silver, iron or copper, for our coinage. Economical errors of the latter sort may isolate us from the rest of the world; but errors in the moral and intellectual or the technical training of the people may make home life less satisfying.

The magnitude of the demand for technical instruction in the United States is greater than is usually supposed, and the real need—which vastly exceeds the demand—is far beyond the ordinary estimates of even the educator engaged in this special work. The writer has estimated that, were the United States, as a whole, to provide as liberally for the technical education of its people as do some of the provinces of France, and of Germany, especially, there would be established:

Twenty technical universities, having in their schools of engineering and higher technics, fifty instructors and 500 pupils each.

Fifty trade schools and colleges, of twenty instructors and 300 students each.

Two thousand technical high schools, or manual training schools, of ten instructors and 200 pupils each.

That is to say, there should be in the United States to-day 1000 university professors and instructors and 10,000 students under their tuition studying the highest branches of technical work ; there should be 1000 college professors and 15,000 pupils in trade schools, studying for superior positions in the arts ; 20,000 teachers engaged in trade and manual training schools instructing pupils, 400,000 in number, proposing to become skilled workmen. We have in this country 10,000,000 families among which are at least 1,300,000 boys who should be in the latter class of schools. The cost of such education would be, per annum, about fifty cents per inhabitant additional to the present school tax, and in the shops of these schools less than \$100 per student, and under \$300 per annum per student for total costs of higher education.

We need, in every State, a technical university, or a technical school side to a university, in which the highest possible grade of professional school shall be maintained, and for all the professions based upon learning. Law and Engineering, Medicine and Architecture, Theology and Agriculture, all have their scientific basis, and their highest provinces and grandest fields lie where only the highest scientific training and widest knowledge can make them satisfactorily productive of good. Their courses should be precisely adapted to the presentation of all modern science, and the best of contemporary practice, to educated and well-prepared disciples, by the great leaders of each. That only can be rightly called a learned profession which demands of all of its practitioners a thorough familiarity with the science as well as with the art of that vocation. The planning of courses taught in professional schools should be capable of being very exactly defined and adjusted to the needs of the profession. The courses of the now more common mixed schools are less easily prescribed.

We need a trade school, or a technical college embracing trade



schools, in every large city in the country. We should have at least one in each of the smaller States, and from two to four in each of the larger and more densely populated States. The East needs weaving schools and schools of industrial art to serve as a foundation for her manufacturing system and her decorative work; the West is in special need of similar schools to stimulate the introduction of manufactures in her agricultural districts. The South is in want of technical and trade schools to give her material to introduce into her cotton mills and metallurgical works. All parts of the United States need many such schools where at the moment one exists. Manual Training Schools are required wherever boys and girls are growing up to lives in which industry and skill are their only ways to competence, or even to security from an old age of poverty and suffering. There should not be less than ten of these schools to every congressional district in the country; and they should be open to the poorest, offering instruction in all the trades to the boys, and in all the domestic arts to the girls.

The curricula of the schools furnish a subject for constant discussion, not only among educators but among parents and pupils. In relation to those of the "culture-schools," those of the scholastic character, which have grown into shape from the monastic period in which they originated, and under the influences of that form of culture which they are intended mainly to perpetuate, there is little question. The purpose and method of the classical education are well defined and settled, from primary school to university; but the later scientific and mixed schools, and the technical schools, have a less well-defined form, as they have a less exactly prescribed purpose. Were we permitted to organize the ideal school and system of education, the task would be comparatively easy, and we should lead the pupil of the primary, through the secondary school into the college and university, finally giving him his professional training after he had acquired as good an education as the time and means may permit. But, even at this advanced period, we often find less than one-half the students in our law schools holding college diplomas and already well educated. The young man seeking to enter a profession must very often, if not usually, either secure his professional training before entering upon the college course, or not at all; and we cannot shut out the best youth of the country from the professions

because, not having inherited wealth, they cannot first secure a liberal education. If this proposition be correct, we find a reason for the fact that the professional schools, as a rule, demand of their entering students only that preparation which is essential to a successful prosecution of the professional studies. It is, at the same time, well understood by all that the possession of a liberal education is in the highest degree desirable, and every young man of sense and ability seeks as much of this great good as his circumstances permit.

In conclusion, and in direct reference to the queries which form the basis of the discussion of the Educational Congress of 1893, at Chicago, the writer may be permitted to submit the following, not as criticisms of existing schools, but as indicating what seems to him the lines of improvement and advancement of our schools and of our systems of education for the immediate future :

1. Progress is visible toward the organization of one "complete and perfect" system of education, in every State, from primary school to State university, which shall be so organized as to offer every citizen, as Huxley puts it, "a ladder from the gutter to the university," and entrance into any one of the existing and of the rising learned professions, into the trades, or into any vocation of work, of leisure, or of self-improvement that he may be able and willing to choose. A national university may perhaps surmount the whole.

2. The technical schools, from kindergarten to technical school of the university or the great independent professional school, are coming to have more definite curricula, to adapt themselves more perfectly, on the one hand, to the needs of the people, and on the other, to the great educational system of which they are to form a part. The higher schools are developing into professional schools; the intermediate grades into trade and mixed schools, the lower into manual training and primary schools with the manual training element descending, in the form of the kindergarten system, into the primary schools. Whether, ultimately, the representative school will have a purely technical or mixed curriculum, is, of course, as yet indeterminable; but the forces of economical change are working strongly in the direction of steady rise, with tendency toward concentration and specialization, from kindergarten to professional school. Yet, as President Walker has sug-

gested, "Possibly some ultimate form for institutions of the higher learning may yet be developed which shall embody much both of the modern school of technology and of the old-fashioned college, with, perhaps, something taken from neither, but originating in the larger, fuller, riper life of a happier and richer future." For the present, the independent schools will probably continue to offer a curriculum containing extra-professional studies. The universities will probably more and more restrict their professional schools to professional work, leaving the student the privilege of either taking his educational course in advance or as contemporary elective work in other departments.\*

3. The Universities are establishing, continually, more and more definitely separated schools of culture and of the applied sciences and of the professions, each having its strictly defined

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\* It is a curious fact that, while the whole tendency, in the United States and in other countries, is obviously toward the organization of a system of state-supported schools, with a state university at the head, and toward a constantly more and more completely hierarchic form, there has arisen in France, at the very fountain head of this movement, a sentiment favoring the destruction of the whole system, the breaking up of the state organization and its replacement by local and limited organizations. The system now in operation, as established in 1808, by the first Napoleon, constitutes the Minister of Public Instruction the head of the national organization. He provides for the inspection of schools and colleges conferring degrees, on recommendation by the proper authorities, and the appointment of professors and teachers, and thus controls the whole educational machinery of France. The country is divided into academic districts, each having its special faculty, with a rector at its head, who is assisted by a corps of inspectors, the scheme being in some respects like that of the University of the State of New York, but endowed with a larger scope of operation and greater powers. In each district an academic council has charge of matters of discipline; a faculty of letters attends to the curriculum in its field and another of science takes charge of that branch. Faculties of law, medicine, and theology supervise the work of the professional schools in each of those departments. Of late, Jules Simon, Jules Ferry, Taine and others have proposed the reconstruction of the system in such manner as to produce a considerable number of local systems, corresponding, somewhat, to our own separate State systems, each with its own local university and underlying secondary and primary schools, breaking up the University of France, as the whole is now called, into a collection of independent, but very similar, smaller provincial universities. One reason urged for this change is that the Academy of Paris secures too large a proportion of students; another is that greater independence is thought desirable in the provincial sections and in the large cities outside Paris.

place, purpose and curriculum, its exactly prescribed conditions of admission to its courses, and employing a staff of specialists to give the instruction which it offers as its peculiar work. The college is confining itself more and more closely to its work of education of the graduate passing into business life or of the man going upward into the university. The schools are similarly taking defined places in the general system and complying more fully with the demand of the college and the university for good preparation of their entering classes, and of the people for a fitting preparation of the youth passing out from them into the common vocations of life. The independent schools are choosing their work, concentrating their strength and energies, and better and better performing a more and more precisely defined part of the great work.

Organization, systematization, concentration, specialization, union of distinctly separated and different elements into an orderly and complete whole are the striking characteristics of the changes now progressing in our whole educational system. The outcome will probably be the formation of complete State organizations of schools, constructed with reference to the needs of a people, from kindergarten and primary school to college and university and professional school, including manual training and trade schools, properly distributed as above indicated to be desirable, and, co-operating with this organic whole, here and there a special school independently doing its chosen work and serving as a stimulus and example to the official school. Washington's great hope—the Washington National University—may perhaps yet take form and secure as its province that of preparation of strong men, of refitting learned teachers and professors for the universities and colleges of the States, and, especially, of carrying on and promoting research in every field of human knowledge. We have had no real university since the days of the Ptolomies and the foundation of the Alexandrian school. The monastic and scholastic element gave us but a narrow and fragmentary education. The introduction of the sciences during the years since Newton and Gilbert, of the applied sciences of Lavoisier, of the arts since Vaucanson, and of instruction in the constructive professions beside that offered the older “learned” professions,—these have reconstructed the university; and now, as never before for two thousand years we have looming up before us the outlines of an

all-enclosing educational structure which comprehends the learning and the principles of the whole range of the literatures, the arts, the sciences of contemporary human development. Of this horizon- and zenith-reaching arch, perfect and complete as it soon may be, culture and learning are the voussoirs and technical education is the keystone which sustains the whole and its superincumbent burden, the higher life of the people.

Those hundred "prophetic voices concerning America" preserved by Charles Sumner in his remarkable little book under that title, unite in predicting marvellous growth and a wonderful future for the people of the United States—which means, at a not distant future time, at least the continent of North America—but this can prove true prophecy only when the people of the United States and of every State shall have performed their greatest work and their noblest duty by insuring to all their successors the lofty privilege of education, each for his own life, and of systematic training, each for his own chosen work in life. De Tocqueville says: "The Americans of the United States, whatever they do, will become one of the greatest nations of the earth."\* We may confidently hope and believe that this prophecy will be ultimately fulfilled; but it will come of highest statecraft, not of politics, of real wisdom, not of policy, and only when the "complete and perfect education" of a great people, for the life and work of a great people, shall have fitted it for its final destiny. It is the steady and rapid evolution of this great system of preparation for a grand destiny that we see now progressing throughout the country and which will soon result in a combination of private, State, and national support of this most substantial of all possible foundations for nationality and life such as will make safe the accomplishment of that most remarkable of all these predictions:

"Westward the course of Empire takes its way;  
The first four arts already past,  
A fifth shall close the drama with the day;  
Time's noblest offspring is the last.†

*R. H. Thurston.*

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\* *De la Démocratie en Amérique*, 1864, Vol. II, Ch. X, p. 399.

† *Bishop Berkeley: Works*, Vol II, p. 443.